Topic 10: Diseases and Immunity

10.1 Pathogens and Transmission

- **Pathogen:** A pathogen is a **disease-causing organism**.
- **Transmissible Disease:** A disease in which the **pathogen can be passed from one host to another**.
- **Transmission Routes:** A pathogen is transmitted:
    - **Directly:** Including through blood and other body fluids.
    - **Indirectly:** Including from contaminated surfaces, food, animals, and air.

Cholera: A Specific Example

- **Cause:** Cholera is a disease caused by a **bacterium** transmitted in **contaminated water**.
- **Mechanism:** The cholera bacterium produces a **toxin** that causes the secretion of **chloride ions** into the small intestine. This leads to the **osmotic movement of water into the gut**, causing severe **diarrhoea**, **dehydration**, and **loss of ions from the blood**.

10.2 Body Defences and Control of Disease Spread

Body Defences (First Line)

The body has several non-specific defences to prevent pathogen entry, limited to:

- **Skin:** A physical barrier.
- **Hairs in the nose:** Filter out particles.
- **Mucus:** Traps pathogens and particles.
- **Stomach acid:** Kills most pathogens in food.
- **White blood cells:** Engulf (phagocytes) or produce antibodies (lymphocytes).

Controlling the Spread of Disease

It is important to control the spread of disease through:

- A **clean water supply**.
- **Hygienic food preparation**.
- **Good personal hygiene**.
- **Waste disposal**.
- **Sewage treatment**

10.3 Immunity

Active Immunity

Active immunity is a **defence against a pathogen by antibody production in the body**.

- **Antigens and Antibodies:**
    1. Each pathogen has its own **antigens**, which have specific shapes.
    2. **Antibodies** are proteins that bind to antigens, leading to direct destruction of pathogens or marking them for destruction by **phagocytes**.
    3. Specific antibodies have **complementary shapes** that fit specific antigens.
- **Acquisition:** Active immunity is gained after an **infection by a pathogen** or by **vaccination**.

Vaccination Process and Role

- **Process:**
    1. **Weakened pathogens or their antigens** are put into the body.
    2. The antigens stimulate an immune response by **lymphocytes** that produce antibodies.
    3. **Memory cells** are produced that give long-term immunity.
- **Role in Control:** Vaccination plays a crucial role in controlling the spread of diseases by establishing **herd immunity**, where a large proportion of the population is immune, protecting vulnerable individuals.

Passive Immunity

Passive immunity is a **short-term defence against a pathogen by antibodies acquired from another individual**.

- **Acquisition:** This includes antibodies acquired **across the placenta** and in **breast milk**.
- **Breastfeeding Importance:** Breastfeeding is important for the development of passive immunity in infants, providing immediate protection against common infections.
- **Memory Cells: Memory cells are not produced** in passive immunity, meaning the defence is temporary.